D&D-45228
Revision 0

Effect on 105KW North Wall due to Addition of Filtration System

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

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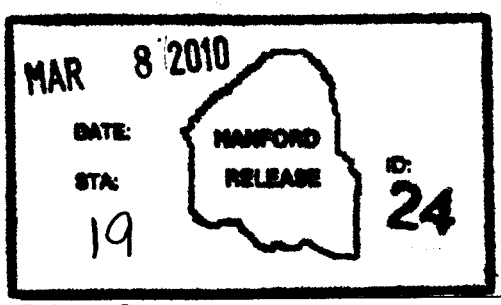

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CHPRC: D&D-45228
EDC : PRC-EDC-10-45229

Title: Effect on 105KW North Wall due to Addition of Filtration

CHPRC D&D Projects is adding three filtration systems on two 1-ft concrete pads adjacent to the north side of existing KW basin building. Attached calculation (Calculation Number 302170-C-1) to this EDC provides qualitative assessment of effect of this addition onto the basin wall.

D&D-45228
Rev 0

Calculation Cover Sheet and Revision Summary

Section 1: Identification					
1. Project Identifier ARES 0846401.30	2. Modification Description Title/Subject Effect on 105KW North Wall due to Addition of Filtration System				3. Page i of ii
4. Use of Form [x] Calculation [ ] Engineering Analysis [ ] Software Installation [ ] Technical Basis [ ] Other					
5. Job Title 100K Utility Upgrades (ARRA)	6. WBS Number N/A	7. Department/Organization CHPRC D&D			
8. Calculation Number 302170-C-1	9. Affected Building Numbers 105KW	10. Room Basin	11. Floor North Wall		
12. Independent Verification Required? [ ] Yes [X] No	13. Performance Category (PC) [ ] 0 [ ] 1 [ ] 2 [ ] 3 [X] N/A				

Section 2: Preparation, Review, and Approval						
14. Rev. No.	15.	16. Originator	17. Checker	18. Approver: Design Authority or System Engineer	19. Supersedes Calc. No. or Rev. No.	20. Field Confirmation Required?
0	Print Name	KC Tu	Steve Cho	Steve Cho		[ ] Yes [X] No
	Sign	KC Tu	Steve Cho	Steve Cho		
	Date	3/1/2010	3/1/2010	3/1/2010		
	Print Name					[ ] Yes [ ] No
	Sign					
	Date					
	Print Name					[ ] Yes [ ] No
	Sign					
	Date					

Section 3: Revision Summary		
21. Rev. No.	22. Description/Reason for Revision	23. Affected Pages
0	Original Issue	1,11,1-5

Registration Stamp (as applicable):	Classification Review:
Signature/Date: _____	Signature/Date: _____

Calculation/Technical Basis Sheet

Section 1: Identification		
1. Project Number ARES 0846401.30	2. Modification Description Title/Subject Effect on 105KW North Wall due to Addition of Filtration System	3. Page ii of ii
4. Calculation Number 302170-C-1		5. Rev. No. 0

Section 2: Scope, Objective, Method, Assumptions, Technical Basis

6. Scope and Objective

CHPRC D&D Projects is adding three filtration system on two 1-ft concrete pads adjacent to the north side of existing KW Basin building. Based on the review of design information available for 105 KW basin substructure, this analysis is prepared to provide qualitative assessment of effect of added pads and filtration system dead weight and seismic load on the north wall.

7. Method

Hand calculations with the assistance of MathCad Version 14.0 Program.

8. Assumptions and Technical Basis

HVAC Filtration System weights 15,000 pound each. 0.20 g Seismic load (p. 1-7 of Ref. 2)

Section 3: Design Inputs/References

9. Ref. No.	10. Inputs/References (with Revision and/or Date or Source)
1	Drawing H-1-91482, Rev.0A, "105KW HVAC Equipment foundation Plan".
2	WHC-SD-NR-SA-024, Rev. 0, "105-KE/105-KW Irradiated Fuel Storage Basin Seismic Qualification Final", by B. V. Winkel, Dec 27, 1991.
3	"Foundation Engineering Handbook", 2nd Ed. Edited by Hsai-Yang Fang, Van Nostrand Reinhold, New York, 1991.

Section 4: Conclusions

Following analysis demonstrates that the newly added filtration units and their pads do not exceed the structural capacity of existing wall. The calculation shows that the total bending moment on the north wall due to newly added filtration units and pads including seismic load is 82.636 ft-kip/ft and is within the capacity of wall which is 139.0ft-kip/ft.

CHPRC D&D

DESIGN ANALYSIS

T.O./Job No.: 302170

Subject: Effect on 105KW North Wall due to Addition of Filtration System
Location: Building 105KW

Originated By: KC Tu date: 3/10
Checked By: Steve Cho date: 3/10

PURPOSE and OBJECTIVE:

CHPRC D&D Projects is adding three filtration system on two 1-ft concrete pads adjacent to the north side of existing KW Basin building. This analysis is prepared to provide qualitative assessment based on the review of design information available for 105KW basin substructure.

In the proposed heating, ventilation and air conditioning (HVAC) filtration pad designs a 2 ft gap will be maintained between the pads and the north end of the existing 105KW-Basin building. Filtration Skids # 2 and #3 share one pad. It is conservative to evaluate the #2 and #3 skid pad for the wall assessment. Figure 1 shows the plan layout of the 105KW basin site and the location of the pads for the filtration system or HVAC skids. Figure 2 shows the cross-section elevation view of the pad. The concrete pad Drawing H-1-91482 directs the replacement of the existing 8" concrete pad with two new 1-ft think pads. The existing 8" pad is separated from the 105KW basin superstructure by an expansion joint of only half an inch. The concrete pad Drawing H-1-91482 shows the gap between the new proposed pads and the north wall and any overflow pits and sumps is 2-ft.

CONCLUSIONS:

Following analysis demonstrates that the newly added filtration units and their pads do not exceed the structural capacity of existing wall. The calculation shows that the total bending moment on the north wall due to newly added filtration units and pads including seismic load is 82.636 ft-kip/ft and is within the capacity of wall which is 139.0ft-kip/ft.

Subject: Effect on 105KW North Wall due to Addition of Filtration System
Location: Building 105KW

T.O./Job No.: 302170
Originated By: KC Tu date: 3/10
Checked By: Steve Cho date: 3/10

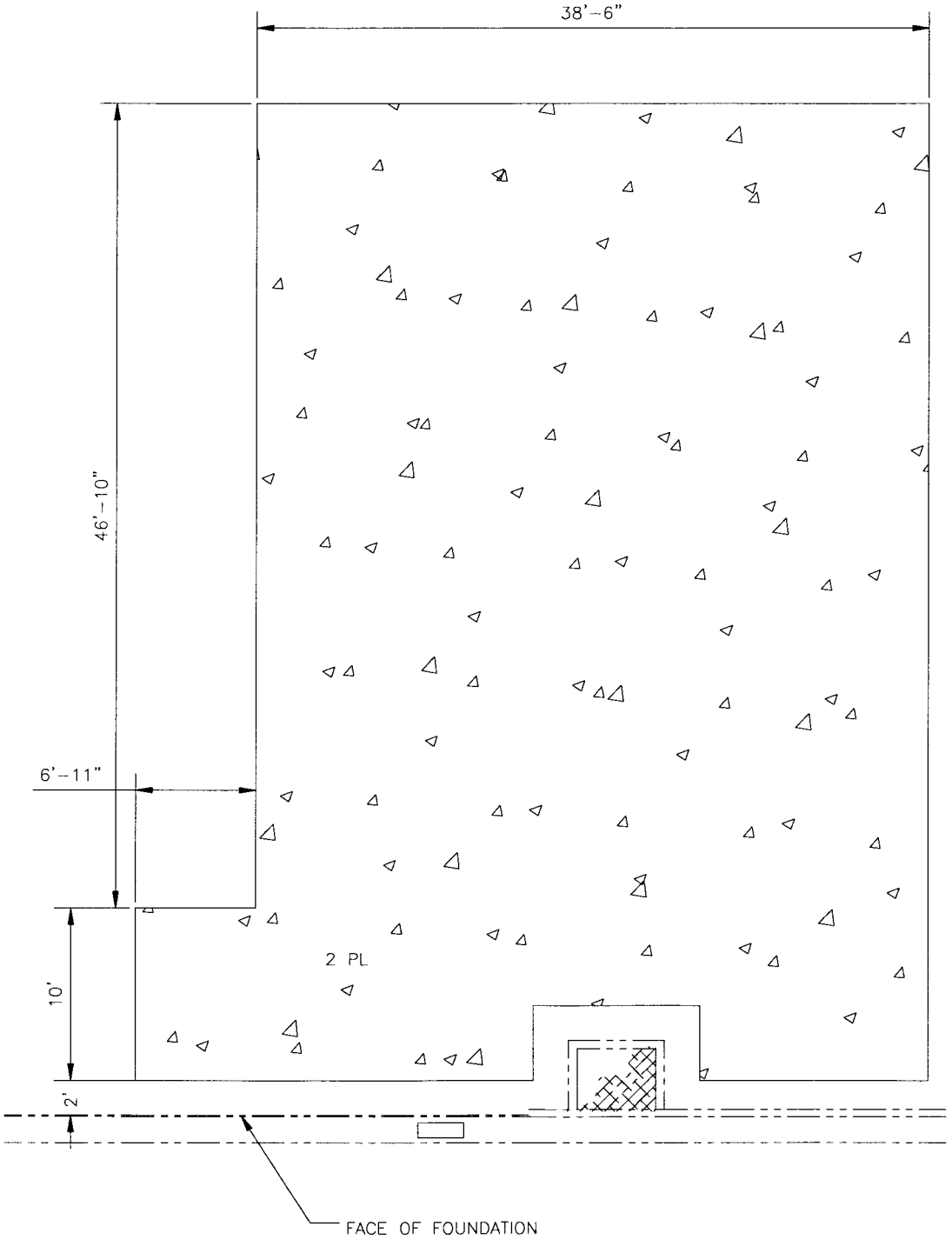

Figure 1 HVAC Equipment Pad

Subject: Effect on 105KW North Wall due to Addition of Filtration System
Location: Building 105KW

T.O./Job No.: 302170
Originated By: KC Tu kct date: 3/10
Checked By: Steve Cho SC date: 3/10

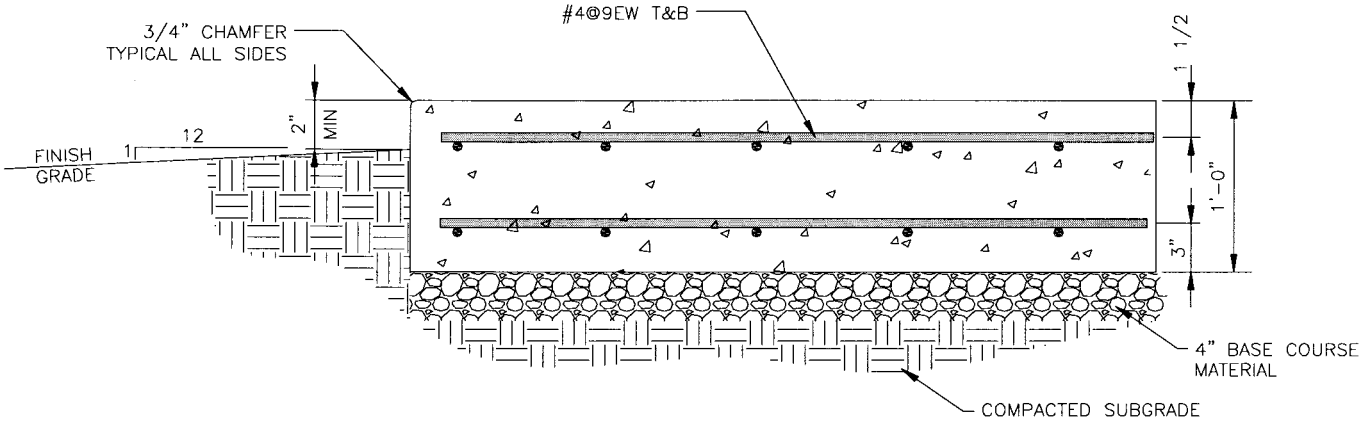

Figure 2 Pad Section

CALCULATION:

$H := 20.75 \cdot ft$	105-KW Basin wall height (p.1-2 of Ref.2)
$EQ := 0.2$	seismic load see p.1-7 of Ref.2 (The equipment and pad are at ground level and rigid. No amplification factor is needed)
$W := 30 \cdot kip$	HVAC equipment weight (units 2 & 3)
$a := 38 \cdot ft + 6 \cdot in$	concrete pad width (parallel to the wall)
$b := 56 \cdot ft + 10 \cdot in$	concrete pad length (perpendicular to the wall)
$d := ft$	concrete pad depth
$e := 2 \cdot ft$	gap between wall and pad
$\rho_{conc} := 150 \cdot pcf$	concrete density
$\rho_{soil} := 110 \cdot pcf$	soil density

$$p := \frac{W}{a \cdot b} + \rho_{conc} \cdot d - \rho_{soil} \cdot (d - 2 \cdot in) = 72.044 \cdot psf$$ soil pressure underneath the pad (2" above grade)

$$p_e := \left(1 + EQ \cdot \frac{2}{3}\right) \cdot p = 81.65 \cdot psf$$ add vertical seismic load (2/3 of 0.2g) to soil pressure

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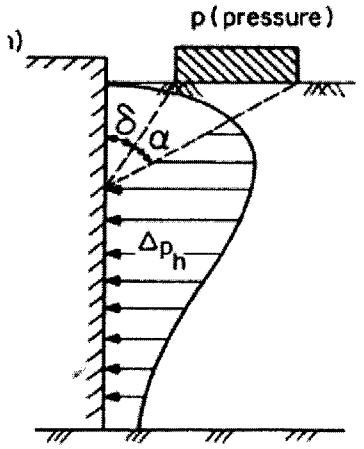
lateral soil pressure due to the equipment, pad, and vertical seismic load [eq. (6.17) of Ref. 3]

$$\Delta p_h = \frac{2 \cdot p_e}{\pi} \cdot (\alpha - \sin(\alpha) \cdot \cos(\alpha + 2 \cdot \delta))$$

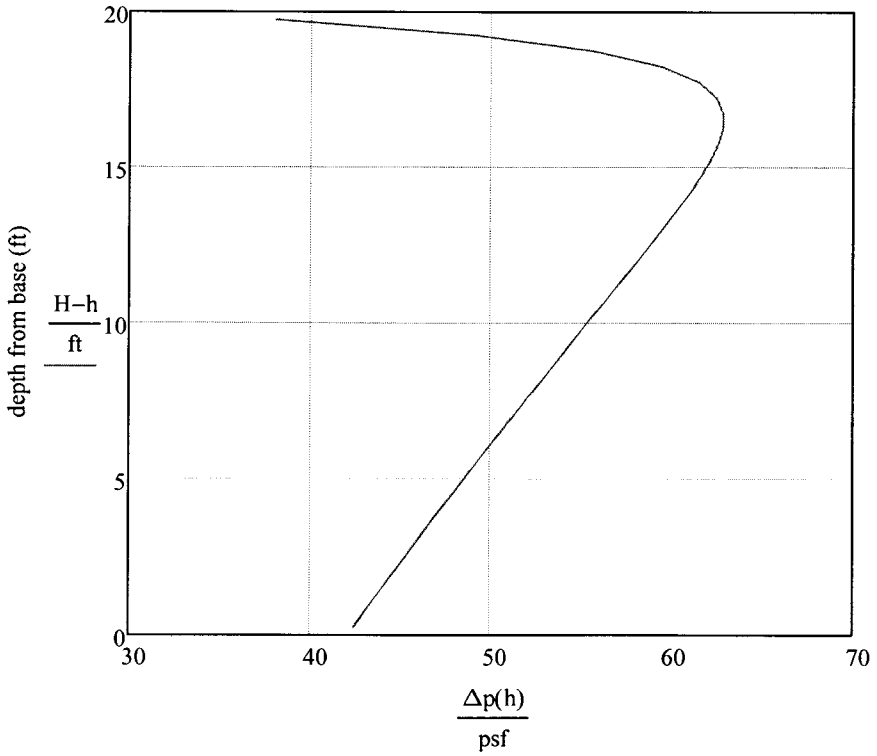
$$\delta(h) := \operatorname{atan}\left(\frac{e}{h}\right)$$

$$\alpha(h) := \operatorname{atan}\left(\frac{e + b}{h}\right) - \delta(h)$$

$$\Delta p(h) := \frac{2 \cdot p}{\pi} \cdot (\alpha(h) - \sin(\alpha(h)) \cdot \cos(\alpha(h) + 2 \cdot \delta(h)))$$



$h := ft, 1.5 \cdot ft .. H$



LATERAL SOIL PRESSURE DISTRIBUTION

Subject: Effect on 105KW North Wall due to Addition of Filtration System
Location: Building 105KW

T.O./Job No.: 302170
Originated By: KC Tu date: 3/10
Checked By: Steve Cho date: 3/10

Demand moment at exterior wall base

Assuming the wall is fixed at bottom, the moments at the bottom

$M_{soil} := \int_{0\cdot ft}^{H} \Delta p(h)\cdot(H - h)\, dh = 11.478\cdot kip$ due to increased lateral soil pressure

$M_{HVAC} := EQ\cdot p_e\cdot b\cdot H = 19.258\cdot kip$ due to EQ of equipment and pad

$M_{exist} := 51.9\cdot kip$ existing demand moment (Table 9-3 on p.9-8 of Ref.2)

$M_{total} := M_{soil} + M_{HVAC} + M_{exist} = 82.636\cdot\frac{ft\cdot kip}{ft}$ total moment with HVAC and pad

$< \quad 139.0\cdot\frac{ft\cdot kip}{ft}$ wall capacity (Table 9-3 on p.9-8 of Ref.2) OK